OMETP

STATISTICAL QUALITY CONTROL

1-2:b3

SOME FUNDAMENTALS OF ELEMENTARY PROBABILITY

I. Definition

If an event may happen in "a" ways and fail to happen in "b" ways, and all of these ways are mutually exclusive and equally likely to occur, the probability of the event happening is a/(a + b), the ratio of the number of ways favorable to the event to the total number of ways.

Example $1/(1+99) = .01$

II. Expression

Probability is expressed as a fraction or decimal fraction which may vary from 0 to 1. A probability of 0 corresponds to an event that never happens under the prescribed conditions. A probability of 1 corresponds to an event that always happens under the prescribed conditions. A probability of .01 corresponds to an event which has 1 chance in 100 of happening under the prescribed conditions; a probability of .1 corresponds to an event which has 10 chances in 100 of happening, etc.

III. Probability Theorems

1. Addition

The probability of the occurrence of either one or another of any number of mutually exclusive events is the sum of the probabilities for the separate events.

Example

Given a circular spinner with numbers ranging from 1 to 100 and each number occurring once, what is the probability of getting either one of the following numbers = 1, 5, 6, 10, 20.

Answer

Applying the addition theorem, the probability of getting any one is $1/(1+99)$. ∴ the probability of getting either is the sum of $\frac{1}{100} + \frac{1}{100} + \frac{1}{100} + \frac{1}{100} + \frac{1}{100} = \frac{5}{100} = .05$

2. Multiplication

If a compound event is made up of a number of separate and independent sub-events, and the occurrence of the compound event is the result of each of these sub-events happening, the probability of occurrence of the compound event is the product of the probabilities that each of the sub-events will happen.

Example:

Given the same spinner, what is the probability of getting a 1 twice in succession.

Answer: $\left(\frac{1}{100}\right)\left(\frac{1}{100}\right) = \frac{1}{10,000} = .0001$

3. Conditional

The probability that both of two dependent events will occur is the probability of the first multiplied by the probability that if the first has occurred, the second will also happen.

Example:

In straight draw poker, what is the probability of getting an ace and matching it with two others.

Answer:

The probability of getting an ace initially is 4/52. The probability of getting the second ace is 3/51. The probability of getting the third ace is 2/50. The conditional probability is (4/52)(3/51)(2/50) = 24/132,600 = .0018.